Mediated Electrochemical Oxidation for Treatment of Mixed Waste

A safe, effective alternative to incineration

Mediated Electrochemical Oxidation (MEO) is an aqueous electrochemical process that can destroy a wide variety of organic chemicals by oxidation, converting them into inert materials such as carbon dioxide and water. Almost complete destruction of organics can be achieved at reasonable electrical efficiencies.

Large quantities of various organic chemicals, contaminated with radioactive and RCRA-listed materials, are stored at sites throughout the DOE weapons complex awaiting suitable means of disposal. MEO can treat these mixed wastes by destroying the organic components and dissolving the radioactive components (even transuranic oxides, which are otherwise difficult to dissolve); the radioactive components can then be recovered (if desired) or immobilized for disposal.

MEO is attractive because it offers a safe and effective alternative to incineration, formerly the most common method for oxidizing organics but no longer acceptable to the public. MEO units are inherently safe for several reasons:

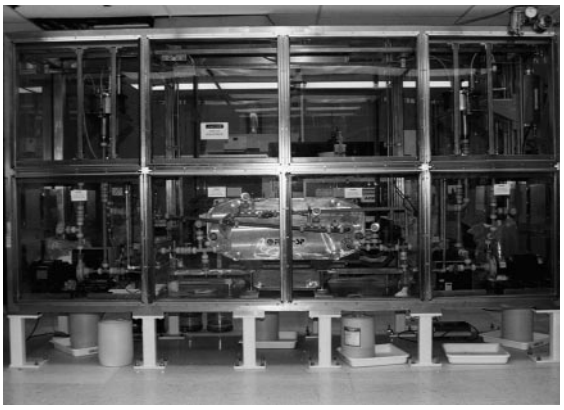
- They operate at moderate temperatures (about 70°C) and at atmospheric pressure.
- They are closed-loop systems, so they present little risk of accidental release into the atmosphere.
- The hazardous and radioactive materials are contained in an aqueous medium, reducing the risk of accidental release.

APPLICATIONS

- *Treatment of liquid and aqueous mixed wastes*
- *Treatment of slurries, sludges, and finely shredded solid wastes*
- *Dissolve surface contamination from equipment and parts*

Recent work

We recently completed extensive studies of MEO destruction of the major organic components found in combustible mixed wastes stored at DOE's Rocky Flats Plant. We tested Trimsol, cellulose (including paper wipes and cloth), rubber (latex), plastics (Tyvek, polyethylene, and polyvinyl chloride) and biomass (bacteria). High destruction efficiencies at reasonable coulombic efficiencies were obtained for all of the organics tested except polyvinyl chloride.



Bench-scale mediated electrochemical oxidation facility equipped with full-scale industrial electrochemical reactor (center). Tests in this facility have achieved 99.99% destruction of cellulosic materials and chlorinated cutting oils.

We have preliminary plans for a pilot-scale system that includes the secondary processes (electrolyte regeneration, mediator recovery, and residual waste removal) necessary for continuous operation, and upstream and downstream processes (solid and liquid feed preparation, off gas and water treatment, and final forms preparation).

Availability: Plans are going forward to commercialize MEO for on-site treatment of mixed waste. We welcome discussions with potential partners from hospitals and biomedical research institutions, chemical and pharmaceutical companies, university laboratories, and elsewhere. Systems capable of destroying 20 to 200 pounds of waste per day are envisaged. The technology is available now.

Contact

Zoher Chiba
Phone: (510) 422-6124
Fax: (510) 422-0096
E-mail: chiba1@llnl.gov
Mail code: L-286